TM 11-1217

WAR DEPARTMENT TECHNICAL MANUAL

POWER METER TS-125/AP

WAR DEPARTMENT *24 FEBRUARY 1945*

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TM 11-1217, Power Meter TS-125/AP, is published for the information and guidance of all concerned.

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(For explanation of symbols, see FM 21-6.)

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DESTRUCTION NOTICE

WHY — To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN — When ordered by your commander.

HOW — 1. Smash—Use sledges, axes, hammers, crowbars, heavy tools.

2. Burn—Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

3. Explosives—Use firearms, grenades, TNT.

4. Disposal—Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT

WHAT — 1. Smash—Thermistor mount, thermistor disks, antenna, attenuators, spare parts.

2. Cut—All wires and cables.

3. Burn—Technical manuals, diagrams, cables, wiring.

4. Bury or scatter—All parts after destroying their usefulness.

DESTROY EVERYTHING

WARNING

HIGH VOLTAGE

is used in the equipment
being tested.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

Be careful to avoid contact with high-voltage circuits or 115-volt a-c input connections while checking or servicing the radar equipment. Make certain that the power is turned off before disassembling any part of the radio equipment.

Dangerously high voltages are present in the power supplies of the radio equipment. Before making any service checks, manually discharge all high-voltage capacitors in these circuits after the a-c power has been removed from the components.

FIRST AID TREATMENT FOR ELECTRIC SHOCK

I. FREE THE VICTIM FROM THE CIRCUIT IMMEDIATELY.

Shut off the current. If this is not immediately possible, use a dry nonconductor (rubber gloves, rope, board) to move either the victim or the wire. Avoid contact with the victim. If necessary to cut a live wire, use an axe with a dry wooden handle. Beware of the resulting flash.

II. ATTEND INSTANTLY TO THE VICTIM'S BREATHING.

Begin resuscitation at once on the spot. Do not stop to loosen the victim's clothing. Every moment counts. Keep the patient warm. Wrap him in any covering available. Send for a doctor. Remove false teeth or other obstructions from the victim's mouth.

Resuscitation

POSITION

1. Lay the victim on his belly, one arm extended directly overhead, the other arm bent at the elbow, the face turned outward and resting on hand or forearm so that the nose and mouth are free for breathing (fig. A).
2. Straddle the patient's thighs, or one leg, with your knees placed far enough from his hip bones to allow you to assume the position shown in figure A.
3. Place your hands, with thumbs and fingers in a natural position, so that your palms are on the small of his back, and your little fingers just touch his lowest ribs (fig. A).

FIRST MOVEMENT

4. With arms held straight, swing forward slowly, so that the weight of your body is gradually brought to bear upon the victim. Your shoulders should be directly over the heels of your hands at the end of the forward swing (fig. B). Do not bend your elbows. The first movement should take about 2 seconds.

SECOND MOVEMENT

5. Now immediately swing backward, to remove the pressure completely (fig. C).
6. After 2 seconds, swing forward again. Repeat this pressure-and-release cycle 12 to 15 times a minute. A complete cycle should require 4 or 5 seconds.

CONTINUED TREATMENT

7. Continue treatment until breathing is restored or until there is no hope of the victim's recovery. Do not give up easily. Remember that at times the process must be kept up for hours.
8. During artificial respiration, have someone loosen the victim's clothing. Wrap the victim warmly; apply hot bricks, stones, etc. Do not give the victim liquids until he is fully conscious. If the victim must be moved, keep up treatment while he is being moved.
9. At the first sign of breathing, withhold artificial respiration. If natural breathing does not continue, immediately resume artificial respiration.
10. If operators must be changed, the relief operator kneels behind the person giving artificial respiration. The relief takes the operator's place as the original operator releases the pressure.
11. Do not allow the revived patient to sit or stand. Keep him quiet. Give hot coffee or tea, or other internal stimulants.

HOLD RESUSCITATION DRILLS REGULARLY

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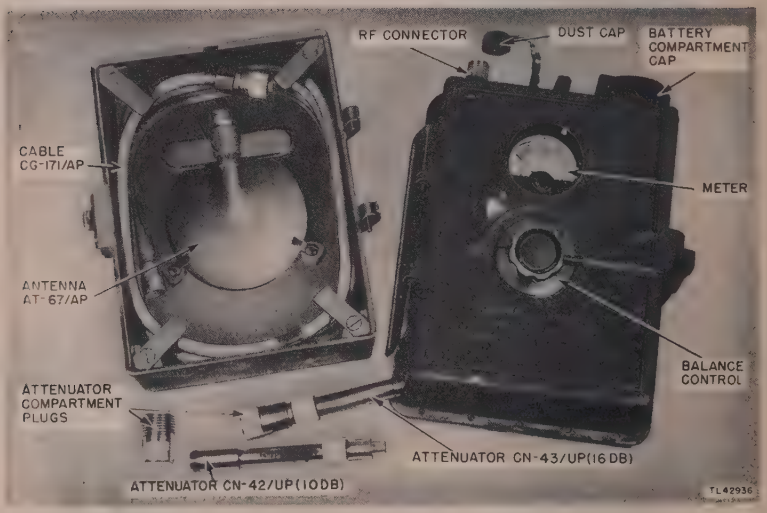

Figure 1. Power Meter TS-125/AP.

PART ONE
INTRODUCTION

SECTION I DESCRIPTION OF POWER METER TS-125/AP

1. GENERAL.

Power Meter TS-125/AP is a compact, battery-operated wattmeter designed to measure r-f power (fig. 1). The power meter is mounted in a cast aluminum case. The unit consists of a microammeter connected in a thermistor bridge circuit, and three standard flashlight batteries. A pick-up horn antenna and an r-f cable are stored in the lid of the instrument, and two attenuators are stored in the case. The meter gives full-scale deflection when 2 milliwatts of r-f power are applied at the input connector. Two scales are provided; one reads milliwatts (mw) of power and the other reads decibels above and below one milliwatt (dbm). An on-off switch and balancing potentiometer are operated by a single control located on the front of the instrument below the meter.

2. APPLICATION.

The power meter is used to check periodically the power output of the radar transmitter with the pick-up antenna in a standard position or with the r-f cable connected directly to a directional coupler (fig. 1). The meter reading is directly proportional to the amount of r-f power fed into the power meter. Average power is indicated.

3. TECHNICAL CHARACTERISTICS.

Sensitivity	2 milliwatts full-scale.
Frequency range	2,400 megacycles per second (mc/sec) (12.5 cm) to 3,335 mc/sec (9.0 cm).
Temperature range	—20° C (—4° F) to 60° C (140° F).
Power source	three 1½-volt dry cells, Batteries BA-30 or equivalent.

4. DESCRIPTION OF MAJOR COMPONENTS (fig. 1).

a. Power Meter. Power Meter TS-125/AP is built in a waterproof cast aluminum case. Three batteries are contained in a phenolic tube and are accessible by means of a screw cap at the upper end of the case. The microammeter is mounted in the upper part of the case and is visible in the front of the instrument through a window. The on-off balancing control is mounted in the center of the case below the meter and is operated by a dial on the front. The thermistor mount, which consists of a section of r-f line and three thermistor resistors, is mounted in the case. The mount has a type-N input connector which projects out of the upper end of the case and is protected by a dust cap. Other resistors associated with the circuit are mounted on terminal boards and on the terminals of the balancing control potentiometer inside the case.

b. Attenuators. The attenuators or pads are two short sections of rigid coaxial line with a resistive center conductor. They are used to increase the range of the meter by attenuating the r-f power. One attenuator has an attenuation of 10 db and the other 16 db. Each attenuator has a type-N plug at one end and jack at the other, and may be attached between the r-f cable and the input connector of the meter. Screw plugs hold the attenuators in their compartments in the lower part of the meter case.

c. R-f Cable. The r-f cable, used to connect the meter to the pick-up antenna or directional coupler, is a weatherproofed flexible coaxial cable, approximately 9 feet long, with two type-N connectors; its attenuation is 7 db. This cable is coiled and stored in the lid of the meter when not in use.

d. Pick-up Antenna. The pick-up antenna is a horn antenna broad-banded to cover a frequency range of 2,400 to 3,335 mc/sec; it has a gain of approximately 8 db. A type-N connector at one end attaches to the r-f cable.

5. LIST OF COMPONENTS.

The following table gives the weights and dimensions of Power Meter TS-125/AP, and lists the major components.

NOTE: Running spares, as shown on this table, are for initial use only and are not to be requisitioned as a kit or group.

a. Equipment Supplied.

Quan	*Component*	*Dimensions (inches)*				*Weight*
		Height	*Width*	*Depth*	*Length*	*(lb)*
1	Power Meter TS-125/AP	10	7⅞	5⅞		12
1	Attenuator CN-42/UP (TPS-51PB/10)				5	
1	Attenuator CN-43/UP (TPS-51PB/16)				5	
1	Cord CG-171/AP with 2 UG-18/U connectors				111	
1	Antenna AT-67/AP	4¼	3½			

b. Equipment Required but Not Supplied. Three Batteries BA-30.

SECTION II

INSTALLATION

6. INSTALLATION OF BATTERIES.

To install the batteries, unscrew the cap on the end of the battery compartment (fig. 1). Insert the three batteries with the positive terminals toward the closed end of the compartment. Replace the cap.

7. REMOVAL FROM SERVICE.

When the meter is not in use, always be sure the switch is OFF. Keep the r-f cable and the antenna in the lid, the attenuators in their compartments, and the lid on the meter. If the meter is to be packed or is out of service for any length of time, remove the batteries from the phenolic case.

PART TWO

OPERATING INSTRUCTIONS

NOTE: For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

SECTION III

PREOPERATIONAL PROCEDURES

8. PREPARATION FOR USE.

a. General. Read the instructions carefully before using Power Meter TS-125/AP. The meter is a delicate electrical instrument and must be handled with care. *Pay particular attention to all cautions;* they are inserted to guide the user and to protect the equipment.

b. Power Meter Check (fig. 1).

(1) Turn switch ON by turning the balancing control clockwise.

(2) Turn the balancing control clockwise until the meter needle swings onto the scale. If the meter does not deflect, check to see if the batteries are installed.

NOTE: If the meter is cold, it may be necessary to turn the balance control completely clockwise and wait 30 seconds or more for the current to warm the thermistor bead to the point where the needle swings onto the scale. The instrument may then be zeroed.

(3) Adjust the balancing control so that the meter reads zero on the upper linear scale (milliwatts). If the meter reading cannot be adjusted to zero, substitute new batteries.

(4) Turn balancing control counterclockwise to OFF in order that the batteries will be disconnected while the set is not in use.

SECTION IV

OPERATION

9. PLACING THE WATTMETER IN OPERATION (fig. 1).

a. Turn the switch ON by turning the balancing control clockwise.

b. Turn the balancing control clockwise until the meter needle swings onto the scale.

c. Balance to zero on the linear scale (milliwatts) with no r-f input by adjusting the balance control.

10. HIGH-LEVEL POWER MEASUREMENTS.

CAUTION: Never connect both attenuators in series. If this were done, too much power would be dissipated in the first attenuator for full-scale deflection of the meter and would damage the attenuator. Also, never connect the input cable directly to the radar transmitter system r-f plumbing.

a. Measuring Power of a Radar Set Using Pick-up Antenna.

NOTE: When power measurements are made using the pick-up antenna, they should always be made at the same time of day, as nearly as possible under the same atmospheric conditions, and with the pick-up antenna in the same position in relation to the radar antenna. If no mounting bracket is provided on the radar set, one should be devised in order that the pick-up antenna can always be mounted in the same place.

(1) Place the wattmeter in operation as explained in paragraph 9 above.

(2) Remove the appropriate attenuator from its storage compartment in the wattmeter case and connect it to the r-f connector of the wattmeter. If the power level to be measured is unknown, use the 16-db attenuator.

(3) Connect the r-f cable to the attenuator.

(4) Connect the other end of the cable to the pick-up antenna.

(5) Support the pick-up antenna in front of the radar antenna at a distance from the radar antenna reflector equal to at least the diameter of the reflector. Keep the open end of the horn facing the radar antenna and polarized in the plane of polarization of the radar antenna. There should be no reflecting object

near by and no conducting material between the pick-up antenna and the radar antenna. The pick-up antenna may be moved farther away from the radar antenna, if necessary, to obtain a suitable reading on the wattmeter. If a mounting bracket is provided with the radar set, mount the pick-up antenna on it.

(6) If the meter reading is below —7 dbm, insert the 10-db attenuator in place of the 16-db attenuator.

(7) If the reading is still below —7 dbm, remove the attenuator and connect the cable directly to the wattmeter.

(8) Record the meter reading in dbm and record the attenuation of the attenuator and cable.

(9) Disconnect the r-f cable from the meter and check to see that the meter is still zeroed. If it is not, readjust the balance control and repeat the reading.

(10) Calculate the average power as explained in paragraph 14 below.

b. Measuring Power of a Radar Set Using Directional Coupler.

(1) Place the wattmeter in operation as explained in paragraph 9 above.

(2) Remove the appropriate attenuator from its storage compartment in the wattmeter case and connect it to the r-f connector of the wattmeter. If the power level to be measured is unknown, use the 16-db attenuator.

(3) Connect one end of the r-f cable to the directional coupler and the other end to the attenuator.

(4) If the reading is below —7 dbm, insert the 10-db attenuator in place of the 16-db attenuator.

(5) If the reading is still below —7 dbm, remove the attenuator and connect the cable directly to the wattmeter.

(6) Record the meter reading in dbm and record the attenuation of the directional coupler, attenuator, and cable.

(7) Disconnect the r-f cable from the meter and check to see if the meter is still zeroed. If it is not, readjust the balance control and recheck the reading.

(8) Calculate the average power as explained in paragraph 14 below.

11. LOW-LEVEL POWER MEASUREMENTS (UP TO 250 MW).

NOTE: The best method of determining the normal power output of the local oscillator is to make this measurement when the set is known to be operating properly.

The local oscillator r-f output may be measured on radar sets which use any one of several types of reflex klystrons or lighthouse tubes as r-f to i-f conversion oscillators. To measure the low-level power, proceed as follows:

a. Place the wattmeter in operation as explained in paragraph 9 above.

b. Connect the 16-db attenuator to the r-f connector of the wattmeter.

c. Connect one end of the r-f cable to the attenuator.

d. Connect the other end of the cable to the local oscillator output jack, using a suitable adapter.

e. If the meter reading is below —7 dbm, insert the 10-db attenuator in place of the 16-db attenuator.

f. If the reading is still below —7 dbm, remove the attenuator and connect the cable directly to the wattmeter.

g. Record the meter reading in dbm and record the attenuation of the attenuator and cable.

h. Disconnect the r-f cable from the meter connector, and check to see if the meter is still zeroed. If it is not, readjust the balance control and recheck the reading.

i. Calculate the average power of the local oscillator as explained in paragraph 14 below.

12. MEASURING ANTENNA PATTERN.

NOTE: The region near and between the radar antenna and the pick-up antenna must be free of reflecting objects, and no conducting material should be between the pick-up antenna and the radar antenna when measuring antenna pattern.

a. Place the wattmeter in operation as explained in paragraph 9 above.

b. Connect the appropriate attenuator to the r-f connector of the wattmeter.

c. Connect the other end of the cable to the pick-up antenna.

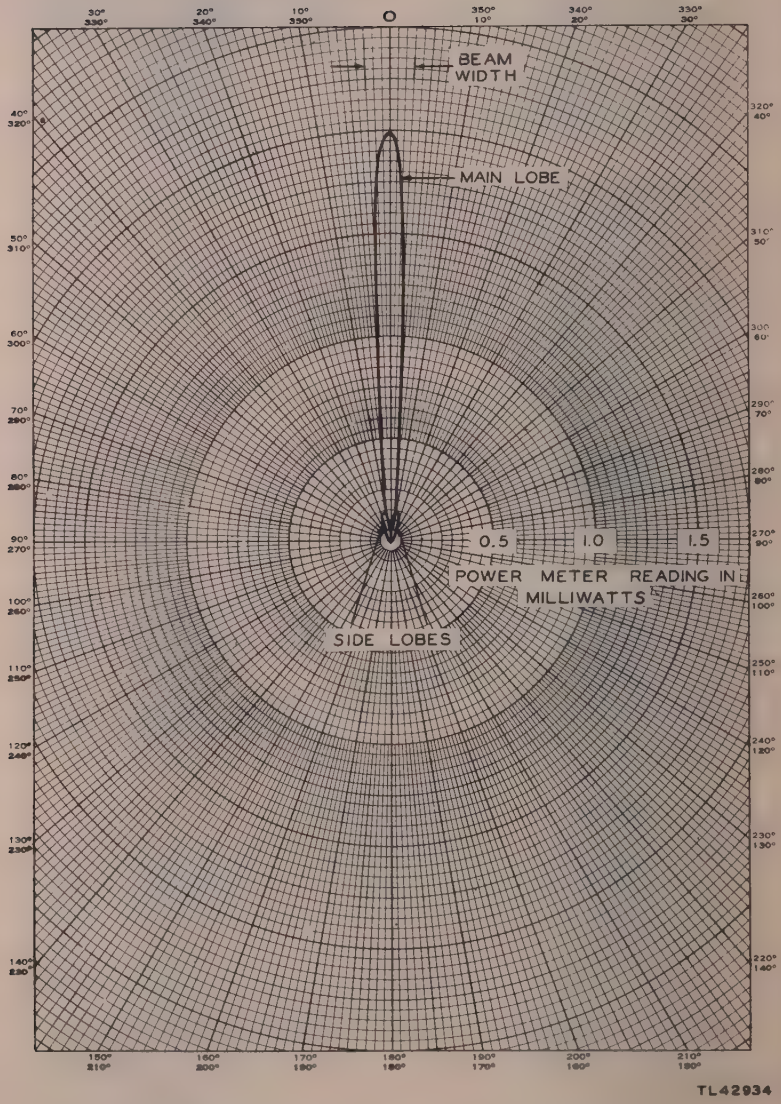

Figure 2. Typical antenna pattern diagram.

d. Support the pick-up antenna on a level with the beam axis at a point at least 15 feet from the radar antenna.

NOTE: For best results, the meter should read as close to fullscale as possible, when the radar antenna is pointed directly at the pick-up antenna. If the reading is too low as originally set up, change attenuators or remove the attenuator; move the pick-up antenna farther away until the reading is at full scale or just below it.

e. Rotate the radar antenna in steps of five degrees, and for each step record the azimuth of the radar antenna and the reading of the meter in milliwatts (the upper scale). When the meter readings increase or decrease rapidly, indicating the presence of a lobe of the radiation pattern, take readings in steps of one degree in order to obtain a representation of the shape of the lobe. Note the azimuth reading when the radar antenna is pointed directly at the pick-up antenna. At frequent intervals during the readings, remove the r-f cable from the wattmeter and check to see that the meter is still zeroed.

f. Convert the azimuth readings of the antenna to angles relative to the position of the pick-up antenna by subtracting algebraically the azimuth of the pick-up antenna with respect to the radar antenna from each successive azimuth reading.

g. On polar coordinate paper plot the meter readings against the angles obtained in subparagraph f to give the variation in power of the radiation with direction (fig. 2).

NOTE: If the pick-up antenna is too close to the radar antenna, the main lobe of the radiation pattern may appear to be distorted. If this occurs, move the pick-up antenna farther from the radar antenna. It may be necessary to remove the attenuator in order to bring the meter back to full-scale reading.

13. MEASURING STANDING-WAVE RATIO.

a. Place the wattmeter in operation as explained in paragraph 9 above.

b. Connect one end of the r-f cable to the r-f connector of the wattmeter.

c. Connect the other end of the cable to an r-f probe on a slotted section of the waveguide of the radar system.

d. If the meter reading is below —7 dbm or above +3 dbm, adjust the depth of the r-f probe to bring the reading onto the scale.

e. Slide the r-f probe along the slotted section of the waveguide to obtain a maximum meter reading. Record this reading in dbm as P_1.

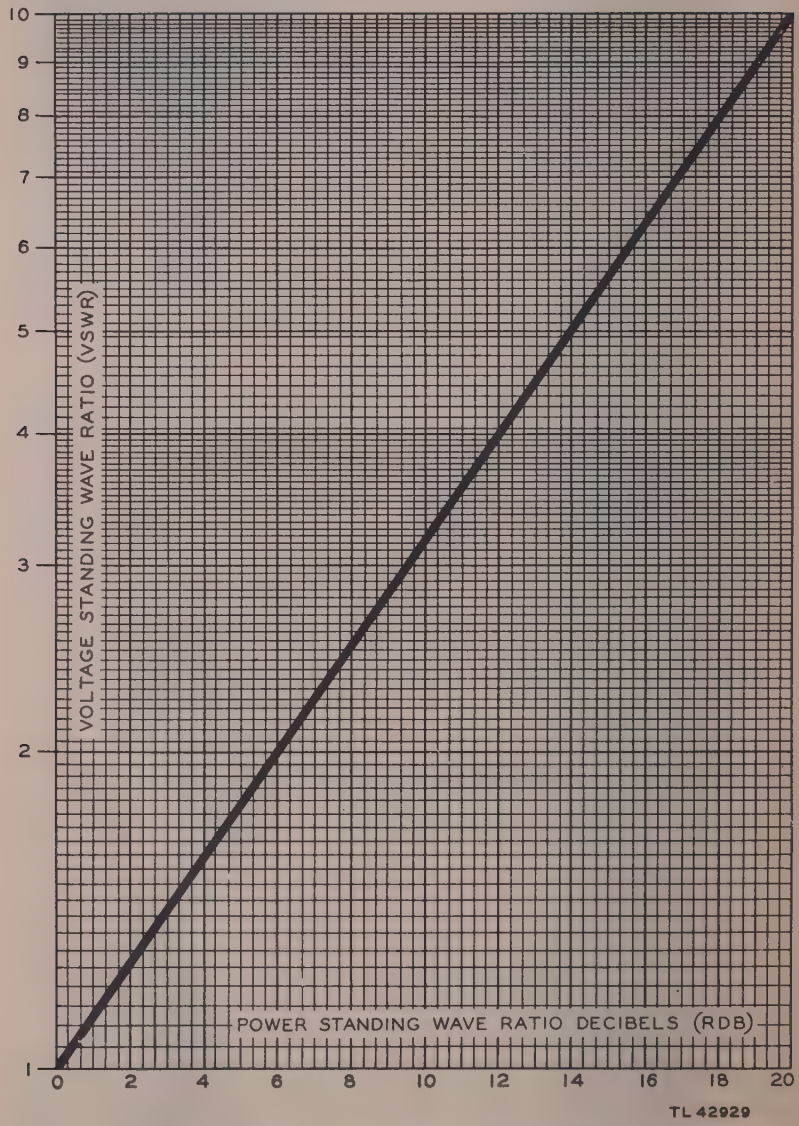

Figure 3. Conversion of power standing-wave ratio to voltage standing-wave ratio.

f. Disconnect the r-f cable from the meter and check to see if the meter is still zeroed. If it is not, readjust the balance control and recheck the reading.

g. Slide the r-f probe to obtain a minimum meter reading. Record this reading in dbm as P_2.

h. Disconnect the r-f cable from the meter and check to see if the meter is still zeroed. If it is not, readjust the balance control and recheck the reading.

i. Compute the power standing-wave ratio in db by subtracting P_2 from P_1 algebraically.

j. Convert the power standing-wave ratio obtained in step i to a voltage standing-wave ratio (vswr) by means of the graph in figure 3.

k. Following is a sample calculation:

$$\begin{aligned} \text{R db} &= P_1 - P_2 \\ P_1 &= 1.0 \text{ dbm} \\ P_2 &= -1.5 \text{ dbm} \\ &= 1.0 - (-1.5) \\ &= 2.5 \text{ db} \end{aligned}$$

From figure 3, 2.5 db = 1.35 vswr.

14. CALCULATION OF AVERAGE POWER.

NOTE: When a pick-up antenna is used, there is attenuation in the space between the radar antenna and the pick-up antenna. This attenuation is variable and depends on the placement of the pick-up antenna with respect to the radar antenna, the distance between the two, atmospheric conditions, etc. Therefore, no absolute measure of the power output of the radar system may be obtained from readings taken when a pick-up antenna is used. If a pick-up antenna is used it should always be mounted in the same position in relation to the radar antenna, and readings should always be taken at the same time of day, and as nearly as possible under the same atmospheric conditions. In this manner a series of relative readings are obtained which give a day-to-day indication of the performance of the radar set. The calculations for finding the average power under these conditions are the same as those given when a directional coupler is used, except that there is no attenuation factor for the coupling device, and that the final power reading obtained is power at

the input end of the r-f cable rather than power in the radar system waveguide.

a. Calculate the average power in decibels above 1 milliwatt (A_{dbm}) by adding, algebraically, the wattmeter reading in dbm and the attenuations of the attenuator, cable, and directional coupler.

b. Obtain the average power in watts from the graph in figure 4.

c. Following are sample calculations:

(1) Assume that the power meter reading is —2 dbm and that the attenuations are as follows: directional coupler, 22 db; r-f cable, 7 db; and attenuator, 10 db.

$A_{dbm} = -2 \text{ dbm} + 10 \text{ db} + 7 \text{ db} + 22 \text{ db} = 37 \text{ dbm}.$

From figure 4, 37 dbm = 5.0 watts.

(2) Assume that the power meter reading is 1.5 dbm and that the attenuations are as follows: cable, 7 db; attenuator, 10 db.

$A_{dbm} = 1.5 \text{ dbm} + 7 \text{ db} + 10 \text{ db} = 18.5 \text{ dbm}.$

From figure 5, 18.5 dbm = 70 milliwatts.

15. CALCULATION OF PEAK POWER.

To calculate the peak power of a radar system, having already determined the average power output, the pulse length and recurrence rate must be known. The peak power may be calculated from the following equation:

$$\text{Peak power in watts} = \frac{\text{Average power in watts}}{\text{Pulse length (in seconds)} \times \text{recurrence rate (per second)}}$$

A sample calculation follows: assume that the average power output is 6.3 watts, the pulse length is 0.7 microseconds, and the recurrence rate is 400 cycles per second.

$$\text{Peak power} = \frac{6.3}{0.7 \times 10^{-6} \times 400}$$

$$= 22{,}500 \text{ watts or } 22.5 \text{ kilowatts.}$$

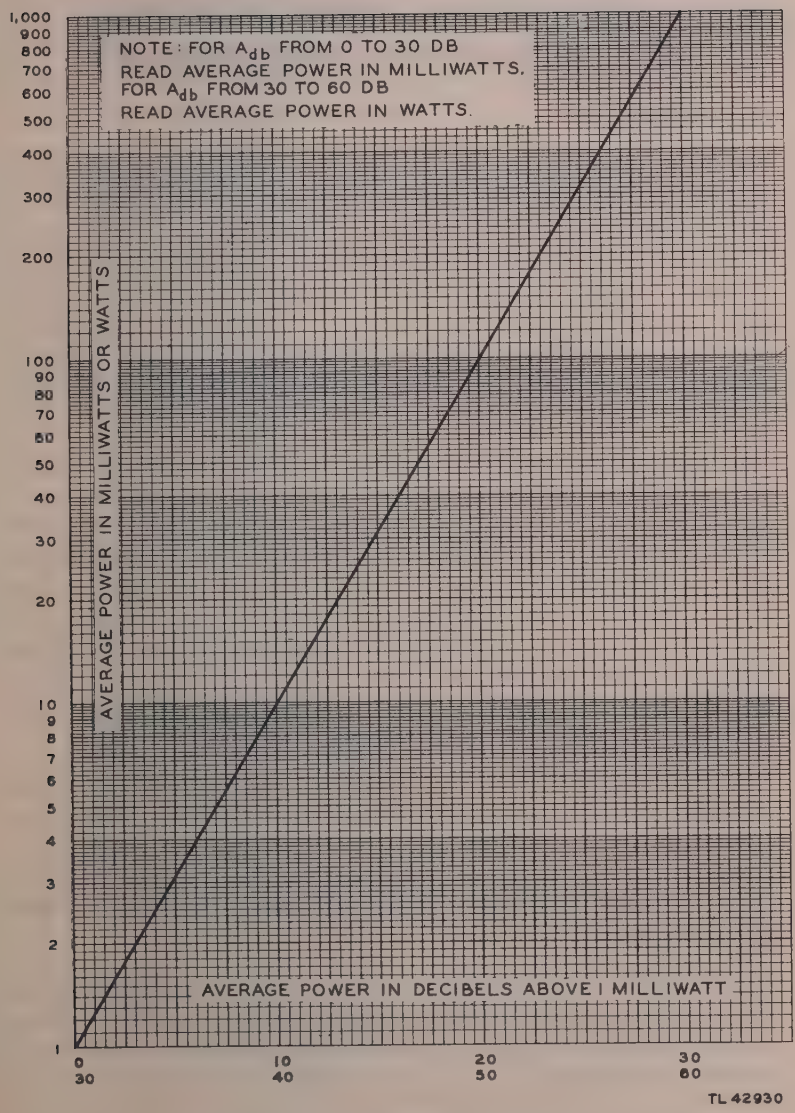

Figure 4. Conversion of decibels above 1 milliwatt to average power.

PART THREE

PREVENTIVE MAINTENANCE

SECTION V PREVENTIVE MAINTENANCE TECHNIQUES

16. GENERAL.

a. Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, when not in use, to prevent major break-downs and to keep the equipment operating at top efficiency. Power Meter TS-125/AP requires routine maintenance at regular intervals in order that the equipment can be kept in excellent condition at all times. This section of the manual contains general instructions and serves as a guide for personnel assigned to perform the four basic maintenance operations, namely: Inspect, Tighten, Clean, and Adjust.

b. The Inspect operation establishes the need for the other three. The selection of operations is based upon a general knowledge of field requirements. For example, the dust of dirt roads filters into equipment during cross-country travel regardless of the care taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the necessary tightening, cleaning, and adjusting, equipment becomes undependable and subject to break-down when it is most needed.

c. Application of the preventive maintenance operation described in this section will be in accordance with the schedule prescribed by the local commander.

17. DESCRIPTION OF PREVENTIVE MAINTENANCE TECHNIQUES.

a. Inspect. Inspection consists of carefully observing all parts of the equipment and noting any signs of overheating, loose or broken connections or mountings, state of cleanliness, proper positioning of wiring, etc.

b. Tighten. This operation consists of tightening loose mounting bolts, screws, and setscrews, and loose or broken connections. Do not overtighten any mountings or terminals.

c. Clean. Remove all corrosion, dust, dirt, and other foreign matter from all parts of the equipment. Use a small, clean paint brush and cleaning cloths to remove dust and dirt. Moisten cloth with a dry-cleaning solvent when required. Crocus cloth or fine sandpaper is used to remove corrosion. Repaint any exposed metal to match the surrounding surfaces.

d. Adjust. This operation as applied to preventive maintenance means primarily the adjustment of the meter pointer to zero mark on the meter scale. Before deciding that the meter needs readjusting, tap the meter case lightly with finger tips to overcome the slight friction which sometimes exists at the bearings and prevents the pointer in an otherwise normal unit from coming to rest at zero. If adjustment is necessary, remove the meter from the case as explained in paragraph 37, and insert the tip of a small screwdriver into the zero-adjusting screw located on the case below the meter face. Turn the adjusting screw slowly until the pointer is at the zero mark. View the meter face and pointer *full on* to avoid the error caused by parallax. Avoid turning the screw too far, for the pointer may bend or the spring may be damaged. Replace the meter in the case.

18. COMMON MATERIALS NEEDED.

The following materials are needed in performing preventive maintenance on the equipment:

Paint brush, small.
Cleaning cloths.
Crocus cloth.
Sandpaper, #0000.
Solvent, Dry-cleaning, Federal Specification No. P-S-661a.
Common hand tools.

NOTE: Leaded gasoline is not recommended as a cleaning fluid for any purpose. Solvent, Dry-cleaning, Federal Specification No. P-S-661a, is available as a cleaning fluid, through established supply channels. Oil, Fuel, Diesel, U. S. Army Specification No. 2-102B, may be used for cleaning purposes when dry-cleaning solvent is not at hand. Since unleaded gasoline is available only in limited quantities, and only in certain locations, it should be used for cleaning purposes only when no other agent is suitable. Carbon tetrachloride will be used, if necessary, *only on contact parts of electronic equipment.*

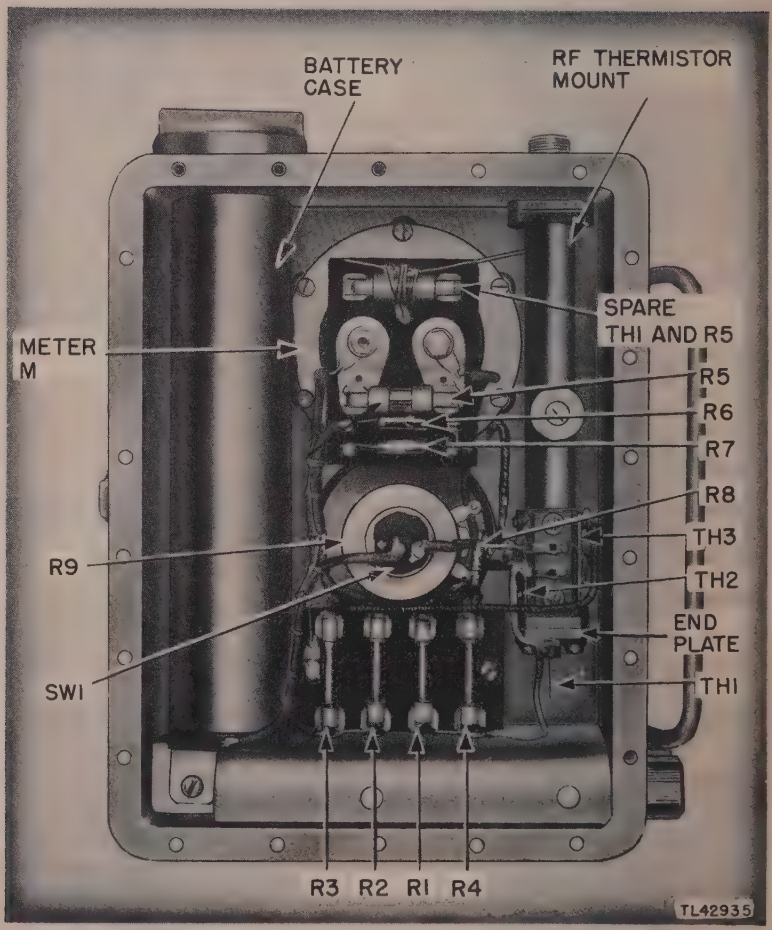

Figure 5. Power Meter TS-125/AP, internal view, parts identified.

19. APPLICATION OF PREVENTIVE MAINTENANCE TECHNIQUES TO POWER METER TS-125/AP (figs. 1 and 5).

General instructions are given below for the application of preventive maintenance operations to Power Meter TS-125/AP. All work is to be performed with the meter disconnected from the radar set. After the completion of the work, the meter should be put into operation and checked for satisfactory performance.

a. Inspect. Observe all parts of the equipment carefully and note any signs of overheating as indicated by discoloration of the affected parts. Note the general condition of batteries, resistors, thermistors, potentiometer, and switch. Look for loose or broken connections, loose mountings and parts, and cut or frayed insulation on the wiring. Examine all recesses in the case for accumulation of dust and dirt, especially between connecting terminals. Parts, connections, and terminals must be free of rust and corrosion. In tropical and high-humidity locations, look for fungus growth and mildew. Moisture will affect the disk thermistors; they are sealed with paint which must not become cracked. Examine the cover gasket to see that it is free from cracks or breaks and forms a tight seal.

b. Tighten. All loose mountings must be securely tightened in place. If connections are dirty or corroded, clean them before tightening them. Tighten all loose terminals and resolder, or otherwise repair, any faulty or broken connections. Tighten the nut which holds the thermistor mount, if it is loose.

c. Clean. All dirt and other foreign matter must be removed from the equipment. Clean all terminal boards, the phenolic battery case, and the thermistor mount with a cleaning cloth. When it is necessary to use a cloth moistened with the dry-cleaning fluid, always wipe the surfaces thoroughly dry with a clean cloth. Do not displace any of the wiring when cleaning within the meter case. Wipe clean the cover glass of the meter.

d. Adjust. Adjust the tension on all loose spring clips. The clips can be adjusted by compressing them gently with the fingers. When zero-adjustment of the meter is required, refer to paragraph 17 for the proper method.

20. REPLACEMENT OF BATTERIES.

Battery life should be about 40 days at 1 hour per day. If the bridge can be balanced, the batteries are still good. Change them

when balancing becomes impossible, unless the temperature is below —20°C (—4°F). If the batteries become swollen and stick in the case, they may be loosened by removing the phenolic tube from the case, unscrewing both ends, and driving the cells out (fig. 5).

21. R-F CABLE (fig.1).

The r-f cable furnished with Power Meter TS-125/AP is subject to damage, weathering, and deterioration. If proper measures are taken, the useful life of the cable can be extended.

a. Inspect the cord regularly for worn and damaged places in the insulation. If any are found, replace the damaged cable immediately.

b. When using the power meter, make sure the cable is not resting on any sharp objects or stretched tightly over any other equipment. Avoid making sharp bends in the cable.

c. Inspect regularly the plugs and fittings on the ends of the cable for corrosion, loose connections, and damaged plug pins. A damaged cable cannot be repaired but must be replaced since any repairs would change the attenuation. Make sure that the pins are clean and making good contact; otherwise, a high-resistance connection or an open circuit will result.

22. ANTENNA AND ATTENUATORS (fig. 1).

The only maintenance necessary on the attenuators and the antenna is to keep them clean and dry. Inspect the connectors to see that they are in good condition and that the pins are making good contact. If these units become damaged, they must be replaced. Change in the value of the attenuators due to arc-over cannot be detected by inspection but must be determined from their performance in connection with the meter.

PART FOUR
AUXILIARY EQUIPMENT

NOT USED.

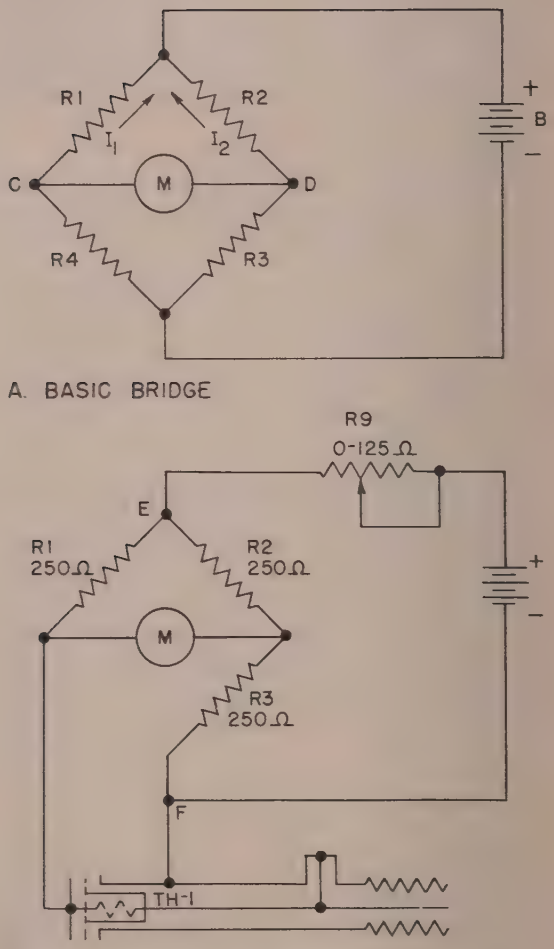

Figure 6. Basic thermistor bridge circuit.

PART FIVE

REPAIR INSTRUCTIONS

NOTE: Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W. D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report). If Form No. 468 is not available, see TM 38-250. Failure or unsatisfactory performance of equipment used by Army Air Forces will be reported on Army Air Forces Form No. 54 (Unsatisfactory Report).

SECTION VI

THEORY OF EQUIPMENT

23. GENERAL.

Power Meter TS-125/AP is a thermistor bridge wattmeter, which measures power by the use of a variable resistance element (thermistor) in a bridge circuit. The resistance of the thermistor decreases with increasing temperature, and vice versa. Changes of thermistor temperature and hence resistance may be caused by thermal changes in its environment, by d-c or a-c currents flowing through it, or by absorption of r-f power.

24. BASIC BRIDGE CIRCUIT.

a. A basic bridge circuit is shown in figure 6A. If the meter, M, is disconnected from the circuit, two parallel paths for current from the battery, B, are provided. One consists of R1 and R4 in series, and the other is R2 and R3 in series. When the meter is connected, some current will flow through it if there is a difference of potential between points C and D. If there is no difference in potential between points C and D, however, no current will flow through the meter and the bridge is said to be "balanced." This condition occurs when the division of the total voltage drop across the bridge is the same in both parallel paths or

$$\frac{I_1R1}{I_1R4} = \frac{I_2R2}{I_2R3},$$

or

$$\frac{R1}{R4} = \frac{R2}{R3}.$$

If any one of the resistances is changed, the above proportion no longer exists, and current begins to flow through the meter in a direction which depends upon the resistance changed.

b. The amount of current flowing through the meter is determined by the amount the resistance is changed. If three of the resistances, for instance R1, R2, and R3, are held constant and the fourth is varied, the current reading of the meter can be used as a measure of the variation in resistance. Note that a change in the battery voltage or in the total current flowing in the system causes no change unless the proportion of the resistances within the bridge itself is changed.

25. BASIC THERMISTOR BRIDGE CIRCUIT.

The basic thermistor bridge circuit in figure 6B is the same as the basic circuit in figure 6A, except that resistor R4 has been replaced by the thermistor TH1 and variable resistor R9 has been placed in the external circuit between the battery and the bridge. This thermistor is a bead thermistor which has a very small mass so that it is easily and quickly affected by any of the factors mentioned in paragraph 23.

a. The resistance of the thermistor thus varies with the current flowing through it, while R1, R2, and R3 are fixed at 250 ohms each. By varying R9 the total amount of current flowing through the bridge, and thus the current flowing through TH1, can be varied. A point may be found at which the resistance of TH1 is 250 ohms; at this point the bridge is balanced. If the resistance of TH1 is changed by some external means such as a change in temperature or by an r-f field, the bridge becomes unbalanced, and the meter indicates a flow of current proportional to the change in resistance of TH1.

b. In Power Meter TS-125/AP, R9 is the balance potentiometer and is used initially to balance the bridge and to zero the meter. Thermistor TH1 is installed in the end of the thermistor mount where it is subjected to the r-f energy to be measured. The r-f power absorbed by the thermistor increases its temperature, decreasing its resistance, and thereby unbalancing the bridge so that current flows through the meter. The current flowing through the meter is proportional to the r-f power absorbed.

26. COMPENSATION FOR CHANGE IN THERMISTOR BRIDGE SENSITIVITY.

a. The sensitivity of the thermistor remains constant over a

broad temperature range, but the bridge sensitivity (microamperes meter reading per milliwatt r-f power) does not. As the temperature decreases, the resistance on thermistor TH1 increases, making it necessary to readjust the balance potentiometer so as to increase the current through the bridge and bring it back to balance. This applies a higher voltage across the bridge between points E and F (fig. 6B). With an increased voltage across the entire bridge, a change in resistance of the thermistor causes a proportionately greater change in voltage across the meter M. The sensitivity of the system thus increases with decreasing temperature.

b. If no temperature compensation were provided, the power meter would always have to be kept at the same temperature when readings were to be taken. In order to compensate for the change in sensitivity of the bridge, a circuit is introduced which causes an opposite change in sensitivity in the meter itself. This circuit consists of thermistor TH2 and resistor R4 connected in series with the meter, as shown in figure 7. Thermistor TH2 is a flat disk fastened in close contact with the side of the thermistor mount. Thus its temperature is the same as the surroundings of TH1 which is inside the mount. As the temperature decreases, the sensitivity of the bridge increases, but the resistance of TH2 also increases. This reduces the sensitivity of the meter. The resistance of R4 is the proper value to obtain the correct rate of change of resistance with changes in temperature so that the sensitivity of the bridge remains constant.

c. The small changes of current in the meter circuit affect the resistance of thermistor TH2 very little because of its relatively large mass. Thus the chief factor affecting its resistance is the temperature of the thermistor mount itself.

27. COMPENSATION FOR ZERO DRIFT.

The compensating arrangement explained in paragraph 26 compensates for changes in sensitivity of the circuit with changes in temperature, but does not eliminate the need for adjusting the balancing control for every change in temperature.

a. In order to reduce the need for readjustment of the balancing control, the network consisting of thermistor TH3 and resistors R6 and R7 (fig. 7) has been added. Resistors R6 and R7 are in series with each other and in parallel with the entire bridge. Thermistor TH3 is in parallel with R7. This network shunts part

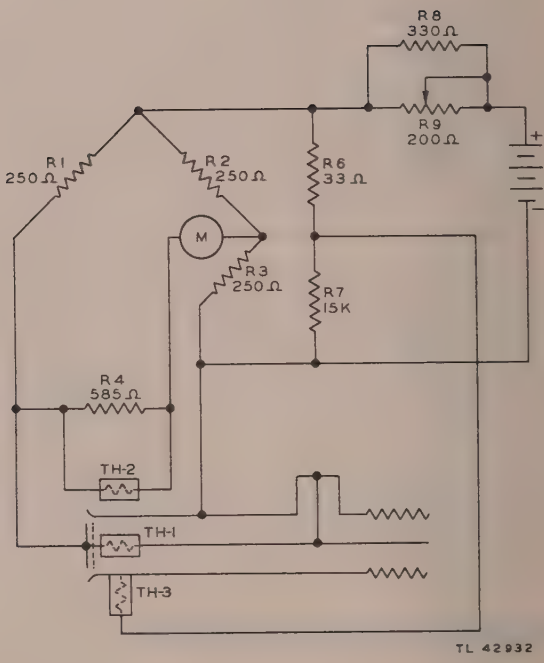

Figure 7. Sensitivity and zero-drift compensation.

of the current from the battery around the bridge. If a decrease in temperature occurs, the resistance of TH3 increases, less current is shunted around the bridge, and a greater amount of current flows through the bridge, and the bridge is balanced.

b. Like TH2, TH3 is a disk thermistor fixed to the side of the thermistor mount. Its resistance depends primarily on the temperature of its surroundings and is relatively independent of the current flowing through it.

28. THERMISTOR MOUNT.

The mount which holds the three thermistors is a section of $\frac{7}{16}$-inch coaxial line with a characteristic impedance of 250 ohms (fig. 8). It is sometimes called a "submarine" mount. A built-in transformer matches the 50-ohm r-f line to the r-f impedence of thermistor bead TH1. The inner conductor of the mount is supported by a quarter-wave stub which presents an infinite impedance to r-f in the line and provides the d-c path from the center conductor. The brass plug around the bead which fits into the mount matches the impedance of the bead to the line. A mica washer insulates the cap from the body of the mount for d-c, but the capacity between the cap and the mount body constitutes an r-f short and completes the r-f circuit. The d-c circuit goes from this plate to the bead, through the center conductor, and through the stub to the mount which is grounded.

29. COMPLETE THERMISTOR BRIDGE CIRCUIT (fig. 8).

a. The compensation networks are designed for an average bead thermistor so that compensation is correct at 0° C, 30° C, and 60° C. Between these points, compensation is very nearly correct. These networks are not perfect for every bead because of the variation of electrical characteristics of bead thermistors; therefore the manual balancing control cannot be entirely eliminated.

b. Resistor R5 is placed in parallel with the meter to allow for factory adjustment of sensitivity of the thermistor bridge to 2 milliwatts full-scale.

c. The 200-ohm potentiometer and 330-ohm shunt in the balancing circuit are selected to permit a maximum resistance of 125 ohms, which is required at high temperature, and a minimum resistance of zero which is required to start the current through the thermistor bead when it is cold. The high resistance of the

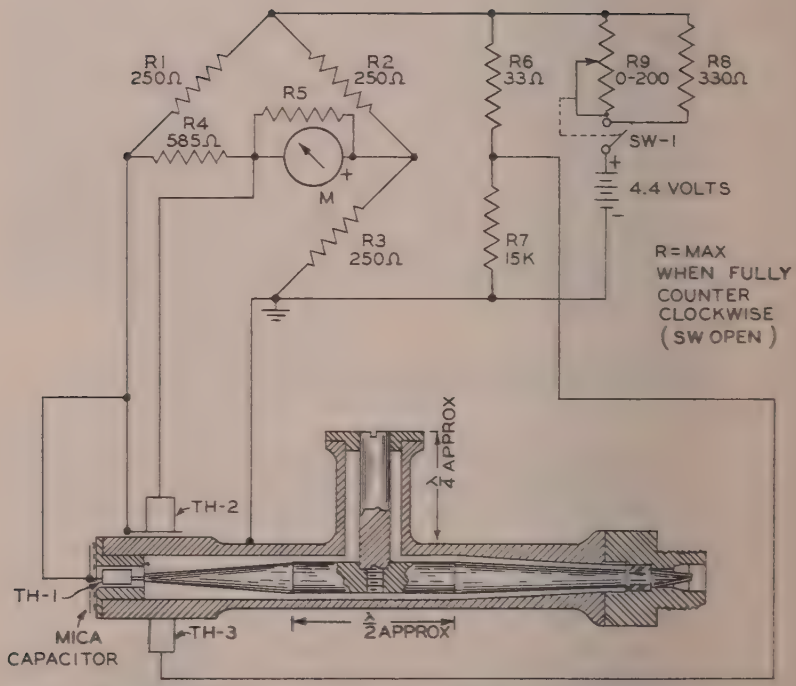

Figure 8. Power Meter TS-125/AP, complete schematic diagram.

bead when cold causes most of the current to flow through the other side of the bridge. If necessary, reduce resistance R9 to zero and wait 30 seconds or more for the small current passing through the bead to warm it up to the point where it may be balanced. Thermistors TH1, TH2, and TH3 have nominal resistance of 250 ohms, 1,420 ohms, and 240 ohms, respectively, at 75° F.

30. ATTENUATORS.

The attenuators are standard sections of 5/17-inch concentric line matched to 49 ohms characteristic impedance at both ends. The center conductor is a glass tubing with a deposited metal film on the surface which has a high resistance. Attenuator CN-43/UP (TPS-51PB/16) has an attenuation of 16 ±1 db, and Attenuator CN-42/UP (TPS-51PB/10) has an attenuation of 10 ±1 db. Each unit is labeled with its attenuation to the nearest tenth decibel. Changes in value of the attenuators may be caused by pulsed r-f arc-over which may burn out metallized film in spots. If this occurs, the attenuation of the pad increases, and it must be discarded.

SECTION VII
TROUBLE-SHOOTING PROCEDURES

31. GENERAL.

CAUTION: Never make any resistance measurements within the power meter while the bridge meter is connected in the circuit. Always disconnect the meter first.

A burned-out thermistor bead and weak batteries will probably cause the most trouble in Power Meter TS-125/AP. Directions for replacing these components are given in paragraphs 20 and 35, respectively. Beads may be burned out by feeding too much r-f power into the thermistor mount. Overloads of r-f cannot change the calibration permanently without burning out the bead. R-f overloads of less than 1 watt (30 db above full-scale deflection) are not usually harmful, because the thermistor bead resistance gets so low that mismatch occurs and little power is transferred to the bead. The trouble-shooting chart in paragraph 32 gives symptoms of trouble which may be observed, probable locations of the fault, and procedure for clearing the fault. No repair which requires recalibration of the meter can be conducted in the field.

32. TROUBLE-SHOOTING CHART.

A. SYMPTOM:
Nothing happens when switch is turned ON and balance control is turned up.

Probable Location of Fault	*Procedure*
1. Batteries.	1. Replace the three dry cells.
2. Switch SW1.	2. Repair or replace switch (fig. 5).
3. Wiring and connections from battery compartment to bridge.	3. Examine wires and connections and repair or resolder broken wires or connections.
4. Meter.	4. If all other parts of main circuit are found to be in order, replace meter. (Meter must be recalibrated.)

B. SYMPTOM:
Needle swings to extreme left of scale when switch is turned ON and cannot be brought to zero.

Probable Location of Fault	*Procedure*
1. Batteries.	1. Replace batteries.
2. Thermistor bead TH1.	2*a*. Remove cap and thermistor bead from mount, and check pigtail connectors at both ends of bead to see that they are making good contact (fig. 5). *b*. Replace bead and meter shunt R5 (par. 35).
3. Resistor R2.	3. Replace R2 (fig. 5). (Meter must be recalibrated.)

C. SYMPTOM:
Needle swings to extreme right of scale when switch is turned ON and cannot be brought to zero.

Probable Location of Fault	*Procedure*
1. Resistor R1.	1. Replace R1 (fig. 5). (Meter must be recalibrated.)
2. Resistor R3.	2. Replace R3 (fig. 5). (Meter must be recalibrated.)
3. Short in mount.	3*a*. Check TH2 to see that it is not shorted to mount (fig. 5). *b*. Check cap on mount to see that it is not shorted to mount (fig. 5).

D. SYMPTOM:

Readings are high at low temperatures and low at high temperatures.

Probable Location of Fault	*Procedure*
1. Disk thermistor TH2.	1. Replace TH2 (fig. 5). (Meter must be recalibrated.)

E. SYMPTOM:

Readings are low at low temperatures and high at high temperatures.

Probable Location of Fault	*Procedure*
1. Resistor R4.	1. Replace R4 (fig. 5). (Meter must be recalibrated.)

F. SYMPTOM:

Readings are consistently low with either attenuator.

Probable Location of Fault	*Procedure*
1. Thermistor bead TH1.	1*a*. Loosen setscrew which holds thermistor pigtail at end of mount and pull on pigtail to make sure bead is seated properly in place (fig. 5). *b*. Replace TH1 and meter shunt R5 (par. 35).

Probable Location of Fault	*Procedure*
2. Meter.	2. Replace meter (par. 37). (Meter must be recalibrated.)
3. Thermistor mount.	3. Replace mount (fig. 5). (Meter must be recalibrated.)
4. R-f cable.	4. Replace r-f cable.

G. SYMPTOM:

Readings are consistently high with either attenuator.

Probable Location of Fault	*Procedure*
1. Meter shunt R5.	1. Replace R5 and thermistor bead TH1 (par. 35).

H. SYMPTOM:

Readings are consistently low with one attenuator.

Probable Location of Fault	*Procedure*
1. Attenuator.	1. Replace the defective attenuator.

SECTION VIII
REPAIRS

33. SERVICING.

Be careful in maintaining and servicing this equipment. Servicing and repair other than the replacement of batteries should be performed only by competent personnel supplied with adequate tools and instruments. An inexperienced operator attempting to locate and repair troubles may destroy the calibration or damage the equipment to such an extent that shipment to a higher repair echelon is necessary.

34. GENERAL REPAIRS.

a. Identification of Leads. It may be necessary to remove other circuit elements to gain access to a defective part. To insure proper reinstallation, keep a record of the connections to each removed element and of the position of the element in the equipment.

b. Electrical Connections. When replacing leads, avoid using more solder than necessary. A very slight amount of excess solder dropped accidentally inside the equipment may cause other circuits or circuit elements to be short-circuited. Some clearances are very small, and extreme care must be exercised in soldering. Do not heat the lug or connection more than is absolutely necessary because of possible damage to near-by elements such as resistors and wiring. Save time and trouble by making a thorough electrical check of any part that appears to be defective *before* removing it from the equipment.

CAUTION: NEVER CHANGE THE LOCATION OF PARTS OR WIRING LEADS. SUCH A CHANGE MAY NECESSITATE COMPLETE RECALIBRATION OF THE EQUIPMENT. NEVER CHANGE THE LENGTH OF WIRING LEADS.

35. REPLACEMENT OF THERMISTOR BEAD (fig. 5).

a. Remove the backplate from the meter.

b. Remove the locknut which holds the thermistor mount in the case.

c. Unscrew the No. 4 screw which holds the solder lug to the terminal end plate on the mount.

d. Unscrew the four No. 6-32 screws (mounted in insulating bushings) which secure the terminal end plate to the mount.

e. Gently remove the terminal end plate from the mount body.

f. Locsen the setscrew on the terminal end plate and remove the burned-out thermistor bead.

g. Remove meter shunt resistor R5 connected across the meter terminals and dispose of it and the burned-out bead.

h. Obtain the new thermistor bead and its matching meter shunt resistor from the spare clips on the meter panel.

i. Detach the thermistor bead from the meter shunt resistor, and insert the shunt in the clips across the meter terminals.

j. Pull out the end plug from the thermistor mount body. This exposes the slotted center conductor of the mount.

k. Insert the short pigtail of the thermistor bead into the slotted center conductor of the mount.

l. Replace the end plug.

m. Be sure to place the mica insulator over the end plug.

n. Guide the thermistor bead pigtail lead carefully through the holes in the terminal end plate which should be so positioned that the hole for the solder lug screw is in the proper position.

o. Replace the four No. 6-32 screws and insulating bushings on the terminal end plate.

p. Pull firmly on the pigtail lead to make sure that the bead rests against the terminal end plate (do not use pliers). If this is not done, a mismatch will occur and cause an error in the instrument.

q. Tighten the pigtail setscrew and replace the solder lug.

r. Replace the thermistor mount in the case and fasten down the cover plate. Be sure to include both gaskets.

36. REPLACEMENT OF THERMISTOR DISKS (fig. 5).

a. Remove the backplate from the meter.

b. Remove the locknut that holds the thermistor mount in the case.

c. Unsolder the pigtail wire of the disk from the lug on the terminal board on top of the mount.

d. Remove the four screws which hold the mounting plate of the disk to the side of the mount, and remove the disk.

e. When replacing the disks, be sure the insulating gasket is placed under TH2.

f. Replace all parts in reverse order.

37. REPLACEMENT OF METER (fig. 5).

a. Remove the backplate from the meter.

b. Remove the two nuts from the meter terminals, and remove the terminal board from the back of the meter.

c. Remove the six flat-head screws which hold the clamping ring around the meter, and remove the clamping ring and meter.

d. Replace all parts in reverse order.

APPENDIX

38. MAINTENANCE PARTS LIST FOR POWER METER TS-125/AP.

Major component	*Ref symbol*	*Signal Corps stock No.*	*Name of part and description*	*Mfr's part and code No.*
		3F3988-67	ANTENNA, horn: Army-Navy Antenna AT-67/AP; parabolic horn type for connection to 50-ohm type N fittings; CDSS #X1554.	
		2Z394.14	ATTENUATOR CN-42/UP; fixed; coax; 5″ lg; platinized glass insert; accurate calibration stamped on sleeve; fits type N connectors; PIB Products, TPS-51 PB/10 DB ±1 DB; CDSS #V1311.	
		2Z394.13	ATTENUATOR CN-43/UP: fixed; coax; 5″ lg; platinized glass insert; accurate calibration stamped on sleeve; fits type N connectors; PIB Products, TPS-51 PB/16 DB ±1 DB; CDSS #V1312-1.	
		3F4325-125/C1	BATTERY BOX: phenolic tubing Nemaxx fungus treated; empty; 1⅝″ OD x 1 7/16″ ID x 7¾″ lg over-all; equipped w/end plug pos cont; 2 mtg studs; cont gasket; #8 solder lug and 6″ lg orange wire attached to lug; for use w/three BA-30 or BA-130 std flashlight dry cells; CDSS #W1109.	
		3Z12531-14.1	BOARD, terminal: 2 sets fuse clips; 1 resistor 15,000 ohms; 1 resistor 33 ohms; one 6″ lead #20 ins copper wire; laminated phenolic; 2¾″ lg x 2″ wd x ⅝″ h x 1/16″ thk over-all; CDSS #W1634.	
		3Z12531-14	BOARD, terminal: 3 solder lug terminals; 4 resistors mtd; phenolic case 2¾″ lg x 1⅝″ wd x 1/16″ thk over-all; 2 mtg holes; CDSS #W1550.	
		3E6015-171	CABLE ASSEMBLY, RF: Army-Navy Cord CG-171/AP; improved Army-Navy Cable RG-21/U calibrated to 7 db; approx 10 ft lg; Army-Navy Plug UG-18/U ea end; CDSS #X1553.	

38. MAINTENANCE PARTS LIST FOR POWER METER TS-125/AP (contd).

Major component	*Ref symbol*	*Signal Corps stock No.*	*Name of part and description*	*Mfr's part and code No.*
		3Z1029-6	CLIP, fuse: phosphor bronze, silver pltd; 0.781″ lg x 0.468″ wd x 0.781″ h; for $\frac{11}{16}$″ ferrule; CDSS #V1054-2.	
		3F4325-125/C2	COVER, connector: aluminum; $1\frac{3}{16}$″ OD x $\frac{7}{16}$″ thk; $\frac{5}{8}$″-24 thread inside; $\frac{5}{8}$″ rubber gasket; 3″ lg of aluminum chain attached; Amphenol AN-3066-A; CDSS #V1151.	
		3F4325-125/C4	COVER ASSEMBLY, attenuator: consists of plugs for TPS-51 attenuators w/4″ chains; plugs 0.840″ OD w/½″ pipe thread and $\frac{5}{8}$″-24 thread inside; CDSS #W1691.	
		3F4325-125/C3	COVER ASSEMBLY, meter: consists of cover; 4 CDSS retainers V1579; 2 CDSS clips V1638; 1 CDSS antenna clip V1054-2; 1 CDSS nameplate (less serial No.) V1556; 2 CDSS hinge pins V1557; ½ of CDSS fastener V1558; CDSS #Z1680.	
		6Z3810-19	FASTENER, latch: cover; steel, zinc pltd; 2¾″ lg x 1½″ wd x $\frac{7}{16}$″ thk; Corbin #1771; CDSS #V1558.	
		3F4325-125/G6	GASKET, rubber: 1⅝″ OD x 1¼″ ID x $\frac{3}{16}$″ thk; CDSS #V1657.	
		3F4325-125/G5	GASKET, rubber: 2″ OD x $1\frac{1}{16}$″ ID x $\frac{1}{16}$″ thk; CDSS #V1142.	
		3F4325-125/G4	GASKET, rubber; $9\frac{5}{16}$″ x $7\frac{1}{16}$″ over-all outside; 8⅜″ x 6⅛″ inside; $\frac{1}{16}$″ thk w/22 holes; CDSS #X1508.	
		3F4325-125/G2	GASKET, synthetic rubber: 1½″ OD x $\frac{11}{16}$″ ID x $\frac{1}{16}$″; CDSS #V1133.	
		3F4325-125/G1	GASKET, synthetic rubber: 2¾″ OD x 2″ ID x $\frac{1}{16}$″ thk; CDSS #V1297.	
		3F4325-125/G3	GASKET, synthetic rubber: 2¾″ OD x $2\frac{3}{16}$″ ID x $\frac{1}{16}$″ thk; CDSS #V1141.	
		3F4325-125/P1	GLAND, watertight: graphited felt; ⅝″ OD x ¼″ ID x ¼″ thk; #9110G w/#300 treatment; CDSS #V1516.	

38. MAINTENANCE PARTS LIST FOR POWER METER TS-125/AP (contd).

Major component	*Ref symbol*	*Signal Corps stock No.*	*Name of part and description*	*Mfr's part and code No.*
		3G1788-19	INSULATOR, plate: cellophane; 0.003″ thk; $1\frac{5}{16}$″ x ⅞″; 4 holes; CDSS #V1182.	
		3G1780-24	INSULATOR, plate: fungus-treated fish paper; 1½″ x 1½″; 2 holes; CDSS #V1477.	
		3G1550-17.1	INSULATOR, plate: mica; 0.002″ to 0.005″ thk; $1\frac{1}{16}$″ x $1\frac{1}{16}$″; 4 holes in corner, 1 in center; CDSS #V1132.	
		2Z5824.40	KNOB, round; aluminum; ¼″ shaft hole; #8-32 setscrew; die-cast 2″ OD; CDSS #X1283-2.	
		3F3304-1	METER, milliwattmeter: 0 to 2 mw; —10 db to +3 db; 2″ phenolic case, 200 μa movement; calibrated 40 div; Marion Elec Inst 2N2B2; CDSS #W1314-1.	
		3F4325-125/N1	NUT, hexagon: duralumin; ⅝″-24; ¾″ head; ¼″ hole through center; CDSS #V1146.	
		3B659	CAP, battery: thumb; aluminum; $1\frac{1}{16}$″-18 thread; 2″ OD x $\frac{5}{16}$″ thk; finger grip ¼″ wd across face; CDSS #V1164-2.	
		3F4325-125/P2	PIN, straight: brass; 0.0003″ cadmium pltd; pin hinge $\frac{3}{32}$″ diam x 1″ lg; CDSS #V1557.	
		2Z5824.40/1	PIN, straight: stainless steel; $2\frac{1}{16}$″ lg x 0.247″ OD, step down to 0.122″ diam; CDSS #V1559.	
	R-106	3Z6003C3-13	RESISTOR, fixed: ww; 33 ohms ±20%; ½w; CDSS #V1105-33.	
	R-101 through R-103	3Z6025-83	RESISTOR, fixed: ww; 250 ohms ±2%; ½w; glass inclosed; CDSS #V1594-250.	

38. MAINTENANCE PARTS LIST FOR POWER METER TS-125/AP (contd).

Major component	*Ref symbol*	*Signal Corps stock No.*	*Name of part and description*	*Mfr's part and code No.*
	R-108	3RC21BE331M	RESISTOR, fixed: composition; 330 ohms ±20%; ½w; AWS RC21BE331M.	
	R-104	3Z6058E5	RESISTOR, fixed: ww; 585 ohms ±2%; ½w; glass inclosed; CDSS #V1594-585.	
	R-107	3RC21BE153M	RESISTOR, fixed: composition; 15,000 ohms ±20%; ½w; AWS RC21BE153M.	
		3Z6926-9	RESISTOR, thermal: disk; oxide pile mtd on metal plate 1¼" x ⅞"; 4 mtg holes; WE #D169228; CDSS #V1180.	
		3Z6926-9.1	RESISTOR, thermal: disk; oxide pile mtd on metal plate 1¼" x ⅞"; 4 mtg holes; WE #D169227; CDSS #V1310.	
	R-109	2Z7278-58	RESISTOR, variable: ww; 220 ohms; 4w; ¼" shaft; switch attached; CDSS #V1509-200.	
	R-105	3Z6926-8.3	RESISTOR UNIT, thermal: fixed resistor and thermistor bead tied together; resistor ww; 60-90 ohms ±1 ohm; approx lw; glass inclosed; CDSS #V-1565; thermistor bead; ⅜" lg x 0.160" diam; 1⅝" axial leads; WE #163903; CDSS #V-1179; CDSS dwg Nos. on outside of envelope.	
		3F4325-125/R1	RETAINER, cord: steel, cadmium pltd; holds Army-Navy Cord CG-171/AP in cover; 1 1/16" lg x ½" wd x 3/32" thk; CDSS #V1579.	
		3F4325-125/S2	SPRING, contact: stainless steel type 302-304; 0.075" diam spring temper wire; spiral ½" diam one end 1½" other end; free lg 1"; CDSS #V1153.	
		3F4325-125/S1	SPRING, plunger: stainless steel; 1¼" free lg x 0.125" diam; wire size 0.016" diam; CDSS #V1560.	
		2Z8877.58	SPRING, retainer: phosphor bronze; silver plated; holds Army-Navy Antenna AT-67/AP inside cover; 4¼" lg x ½" wd x 0.0179" thk; CDSS #V1638.	
		3F2833	WINDOW, meter: plexiglas; 2¾" diam x ⅛" thk; CDSS #V1143.	

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